Chemistry 129.01 - General Chemistry Workshop - Spring 2017

Week #1

Class Preparation Assignments for Week 1

This week we have a lot of reading to do. The assigned readings should be done prior to coming to class. Try to do some planning now about how you will structure your week to get all of this reading done. Doing this reading well so that you are prepared when you come to class will make the biggest difference in your ability to learn chemistry and work in groups. These reading assignment sheets are intended to give you guidance for attacking the most important parts of the reading.

Also, in addition to the assigned reading for this week, review on your own Chapter 1, especially units of measurement and dimensional analysis and significant figures (see handouts).

Monday, January 23. Introduction to CHM129, Lab Safety and Chemical Reactions.

Assigned reading: Sections 4.1 and 4.2

Stoichiometry: This semester we are learning tools that are used in the description and understanding of chemistry. The first of these tools is stoichiometry. Stoichiometry is simply counting. In particular, we are counting the elements in any given chemical compound or reaction.

Section 4.1 introduces the central part of stoichiometry which is balancing chemical equations. Whether a chemical equation is balanced well or not will affect the result of limiting reagent problems so this concept is very important. What you need to focus on in the reading is the idea that matter is neither created nor destroyed during a chemical reaction. Therefore, all of the atoms on the left hand side of the equation need to be on the right hand side of the equation in equal numbers. I want you to pay close attention to the sample exercise (4.1) in this section. Don't worry about nomenclature (compound naming) right now, we'll start working on it next week. Work through the practice exercises for good practice on this concept.

1. Define the following concepts and symbols:

   reactant

   product

   balancing a chemical equation

2. Balance the following chemical equation and identify the reactants, products and stoichiometric coefficients. What type of reaction is this?

$$C_{(s)} + O_{2\,(g)} \rightarrow CO_{(g)}$$

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Wednesday, January 27. The Mole and Limiting Reagent

Assigned reading: Sections 3.1, 4.3-4.4

Section 3.1: Section 3.1 is merely an introduction to the basic makeup of elements and how chemists measure the mass of and count the number of atoms and molecules. In other words, the ideas in this section are teaching you the basics of counting . . . chemistry style. This section describes determining the mass of individual atoms. These masses are very, very small. Before coming to class, look at the conversion between amu (atomic mass units) and grams found inside your book (amu's are small, hunh?). I also want you to study how formula weights are determine (see example 3.1 for ibuprofen). In particular, identify the atomic weights (AW) for each of the elements in the formula. Where did these come from? (Answer: periodic table). Note also the use of significant figures in these formula weights. Also, pay special attention to "THE MOLE". Because the mass of an individual molecule is so impossibly small for us to deal with on a day-to-day basis, we use the concept of a mole. The mole is the chemist's version of a dozen. If you understand how to use the term, "a dozen", you understand how to use the term "a mole".

Section 4.3 and 4.4: Chemistry is really not just about studying individual compounds; rather, it is about studying the interaction or reaction between compounds. Sections 4.3 is your introduction to how stoichiometry is used to describe reactions. There is one principle concept: matter (stuff, chemicals) is conserved (neither made nor destroyed). This section has examples of detailed calculations that are used quite commonly in chemistry. You might want to try working through the examples and check your answers against those given in the book. Notice that we use the ratios determined by the balanced reaction and the molar masses of compounds to determine the masses needed or produced. The trick with this material is <u>writing down your units</u>. Now, sometimes when you run a reaction you run out of one of the materials needed, and so the reaction stops. Stoichiometry allows you to, given an amount of each of your reagents (reactant), to determine which of those reagents will "limit" the reaction and how much product will be produced.

Before Wednesday's class,

1. Define the following terms:

   Average atomic mass

   Mole (not the furry kind)

   Molar mass/molecular weight

   Limiting reagent

2. What is the molar mass of O_2? How many O atoms in one mole of O_2?

3. Consider this 'reaction': **1 crust + 5 ounces of tomato sauce + 2 cups of cheese → 1 pizza**
   Suppose we have 4 crusts, 10 cups of cheese and 15 ounces of tomato sauce, how many pizzas can we make? Limiting ingredient?

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Friday, January 29. Determining Chemical Formulas and Solutions

Assigned reading: Sections 3.2-3.4, 4.5

Section 3.2: Section 3.2 introduces percent composition and describes the process to determine the empirical and molecular formulas of compounds. The chemical formula of a compound a depicts that compound using symbols to denote the types of atoms and the number of atoms of each type. In other words, it's an abbreviation of the name of the compound. We'll learn the naming rules next week (nomenclature) but we'll learn how to determine the chemical formulas first. Pay close attention to the example in section 3.2 but especially to example 3.13.

Section 3.3 and 3.4: These sections introduce the concept of solution and describe different ways to express concentration. Expressing the concentration of a solution requires that you transmit the amount of solute(s) relative to the amount of solvent. One of the most common ways to express concentration is molarity and we'll focus on this one in class but it is important that you learn other forms of concentration expression as well.

Before Wednesday's class,

1. Define the following terms:

   Percent composition

   Empirical Formula

   Molecular Formula

   Solute

   Solvent

2. What's the empirical formula of C_2H_2?

3. How do we calculate the molarity of a solution?

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Problem Set #1

Due Monday, January 30 (at the beginning of class). Late homework will not be accepted.

1. Calculate the percentage by mass of all the elements in cisplatin, $PtCl_2(NH_3)_2$

2. Balance the following chemical reactions and indicate whether they are combination, decomposition, combustion, single displacement or double displacement:

   a. $N_{2\,(g)} + H_{2\,(g)} \rightarrow NH_{3\,(g)}$

   b. $Cu_{(s)} + AgNO_{3\,(aq)} \rightarrow Ag_{(s)} + Cu(NO_3)_{2\,(aq)}$

   c. $C_5H_6O_{(l)}\ O_{2\,(g)} \rightarrow \quad CO_{2\,(g)} \quad + H_2O_{(g)}$

3. Calculate the following quantities:

   a. mass in grams of 1.0×10^{-2} mol of NaCl

   b. number of moles of 76.5 g of TiO_2

   c. number of molecules of CO_2 in 0.105 mol of CO_2

4. Consider the following reaction:

$$2\ KI_{(aq)} + Pb(NO_3)_{2\,(aq)} \rightarrow PbI_{2\,(s)} + 2\ KNO_{3\,(aq)}$$

   Calculate how many grams of KI are necessary to completely react with 55.8g of $Pb(NO_3)_2$.

5. Consider the following reaction:

$$Mg_{(s)} + O_{2\,(g)} \rightarrow MgO_{(s)}$$

   When 10.1g of Mg is allowed to react with 10.5g of O_2, 11.9g of MgO is produced. Find the limiting reagent, theoretical yield (in grams), and percent yield.

6. Determine the empirical and molecular formulas of the following compounds:

   a. A compound that has the following composition: 58.80%C, 9.87%H, 31.33%O. Its molar mass is 102.13g/mol.

   b. A 4.30g sample of a compound was combusted, producing 8.59g of CO_2 and 3.52g H_2O. The molar mass of the compound is 88.11g/mol.

7. How many grams of NaCl are needed to prepare 250.0mL of a 0.0475M solution? (b) How many mL of a stock solution of 10.0M HNO_3 would you have to use to prepare 0.450L of 0.500M HNO_3?

8. Balance the following reaction:

$$HCl_{(aq)} + Ba(OH)_{2(aq)} \rightarrow BaCl_{2\,(aq)} + H_2O_{(l)}$$

   What volume of a 0.150M $Ba(OH)_2$ solution is required to completely react with 125mL of 0.150M HCl? What is the concentration of the $BaCl_2$ solution formed?